

Asthma Hospitalizations Among Children in Detroit, Michigan (1990-96): Zip Code Level of Analysis

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Abstract

Background: Examining the number and rates of hospitalizations at the zip code level may provide useful information for etiologic and interventional studies. This study describes characteristics of asthma hospitalizations by zip code in Detroit from 1990-1996.

Methods: Asthma hospitalizations (ICD-9-CM 493) for Detroit children ages 1-14 were classified by residential zip codes. Hospitalization rates were analyzed by demographic, temporal, and health services-related factors.

Results: The average annual increase in the number of hospitalizations varied across the 27 zip codes (0.8%-13.0%) as compared with Detroit (4.6%) from 1990-1996. High zip code rates were associated with high rates in school-aged children (5-14). High zip code rates were also associated with a higher number of comorbidities (48.5% and 37.5% respectively).

Conclusion: High rates of asthma hospitalizations did not always correlate with high absolute numbers at the zip code level. This analysis illustrates how variation in asthma rates can be useful in determining etiology, as well as spatial and temporal patterns for targeting interventions.

Background / Objectives

- Asthma hospitalization rates in Detroit children (1-14 years) are higher
 - among male children than female children
 - among preschool-aged (1-4) than school-aged (5-14) children
 - among African American children than White children
- Objective: Determine the variability in childhood asthma hospitalization rates by zip code and identify areas of greatest burden

Methods - 1

- Data Sources:
 - Michigan Inpatient Data Base, 1990-1996
 - Hospitalizations were classified according to the 27 residential zip codes
 - Zip codes with fewer than 100 childhood asthma hospitalizations from 1990-96 were excluded from analysis (Zip #48226)
 - Childhood: 1-14 years of age
 - Asthma hospitalization: Primary diagnosis of asthma
 - (ICD-CM-9 493)
 - Comorbidities: Hospitalization diagnosis in addition to primary diagnosis of asthma
 - 1990 U.S. Census population estimates by zip code

Methods - 2

- Analysis
 - Age-, gender-, & race-specific rates per 10,000 population were calculated by zip code for children 1-14 years from 1990-1996
 - Zip code level rates were then divided into quartiles
 - Hospitalization rates & rate ratios for gender (M/F), age (1-4/5-14), and race (AA/W) were compared across zip codes
 - Age- and gender-specific rates and rate ratios were mapped by zip code
 - Correlation analysis was used to compare socioeconomic and demographic variables

1990 Economic Indicators by Detroit Zip Code from U.S. Census

	<i>Median</i>	<i>Range</i>
% Households with income < \$15,000	50%	23 – 79%
% Adults >25 with <12 years education	42%	24 – 57%
% Households receiving public assistance	29%	14 - 43%

Results - 1

- 1990 population varied by zip code from 1,332 to 18,176 children (Fig. 1)
- The total number of childhood asthma hospitalizations varied from 111 to 1,045 (Fig. 2)
- Rates varied from 48.0 to 239.9 per 10,000 population (Fig. 3)
- Rates were highest in the center of the city
- 5 zip codes were in the highest two quartiles for both number & rate of hospitalizations
- The relative percent change in rates from 1990 to 1996 varied from -5% to +97% (Fig. 4)

Figure 1: 1990 Detroit Population (1-14 years) by Zip Code

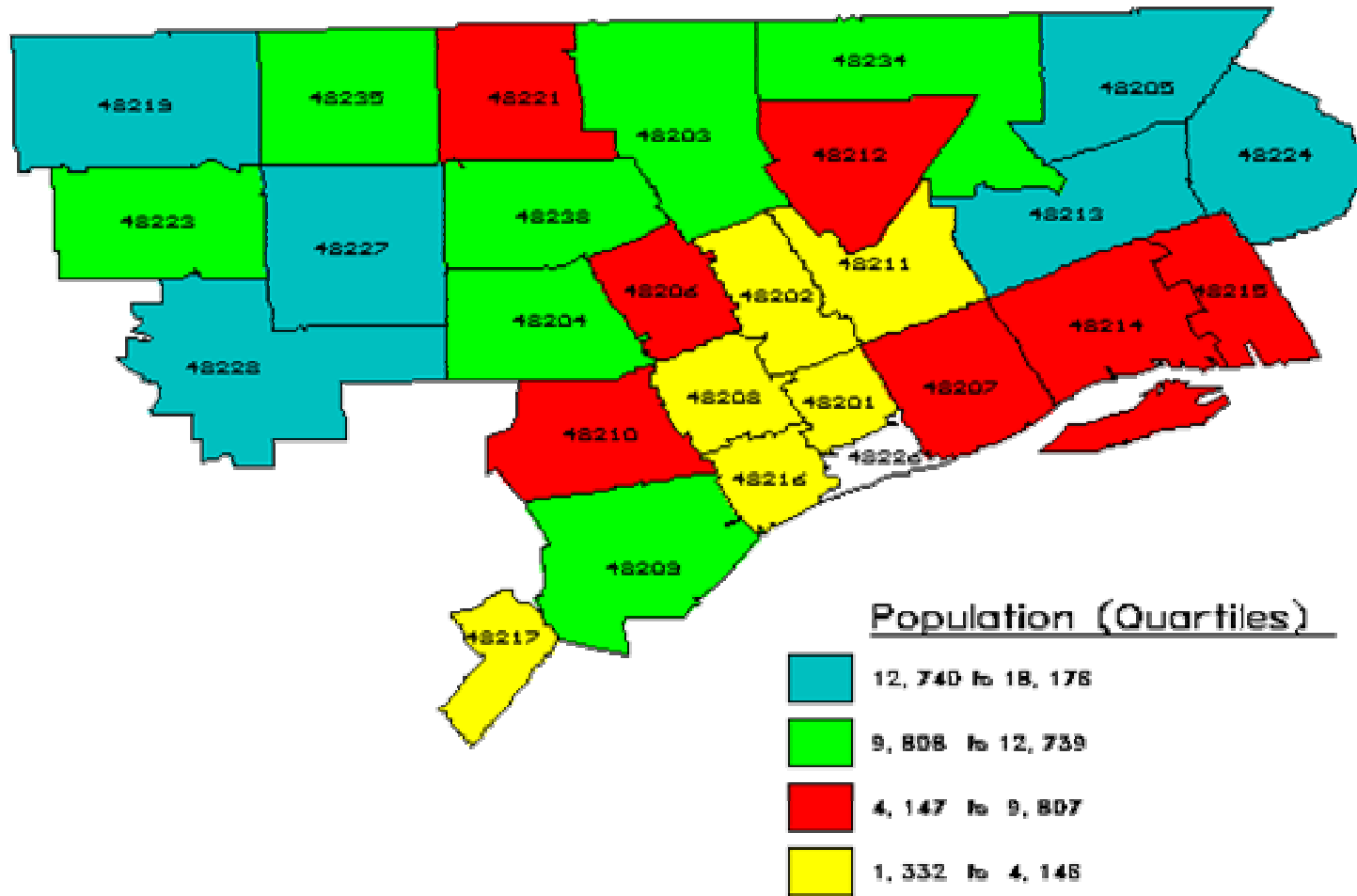


Figure 2: Total Number of Childhood Asthma Hospitalizations, 1990-96

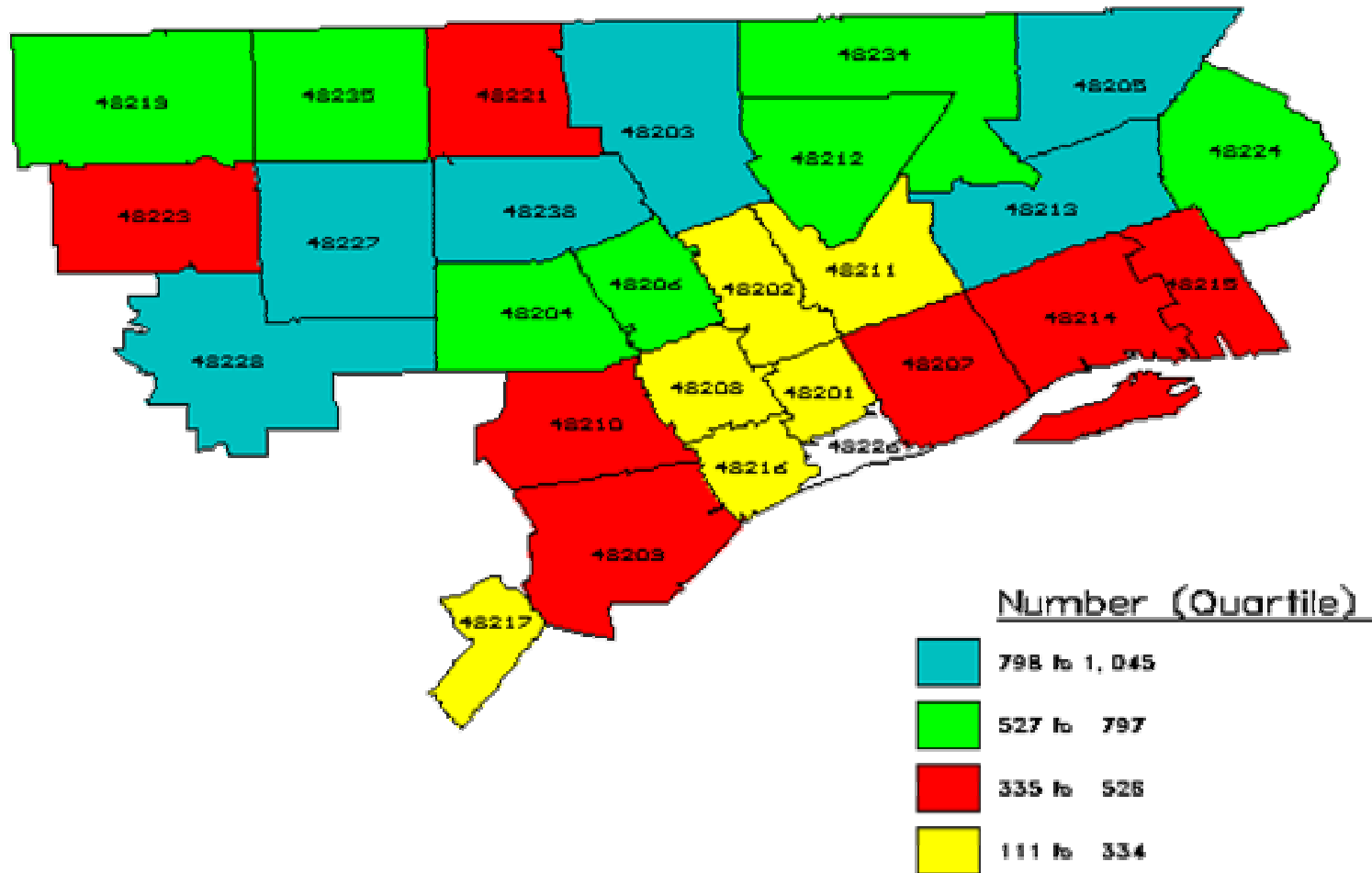


Figure 3: Childhood Asthma Hospitalization Rates, Detroit Zip Codes, 1990-96

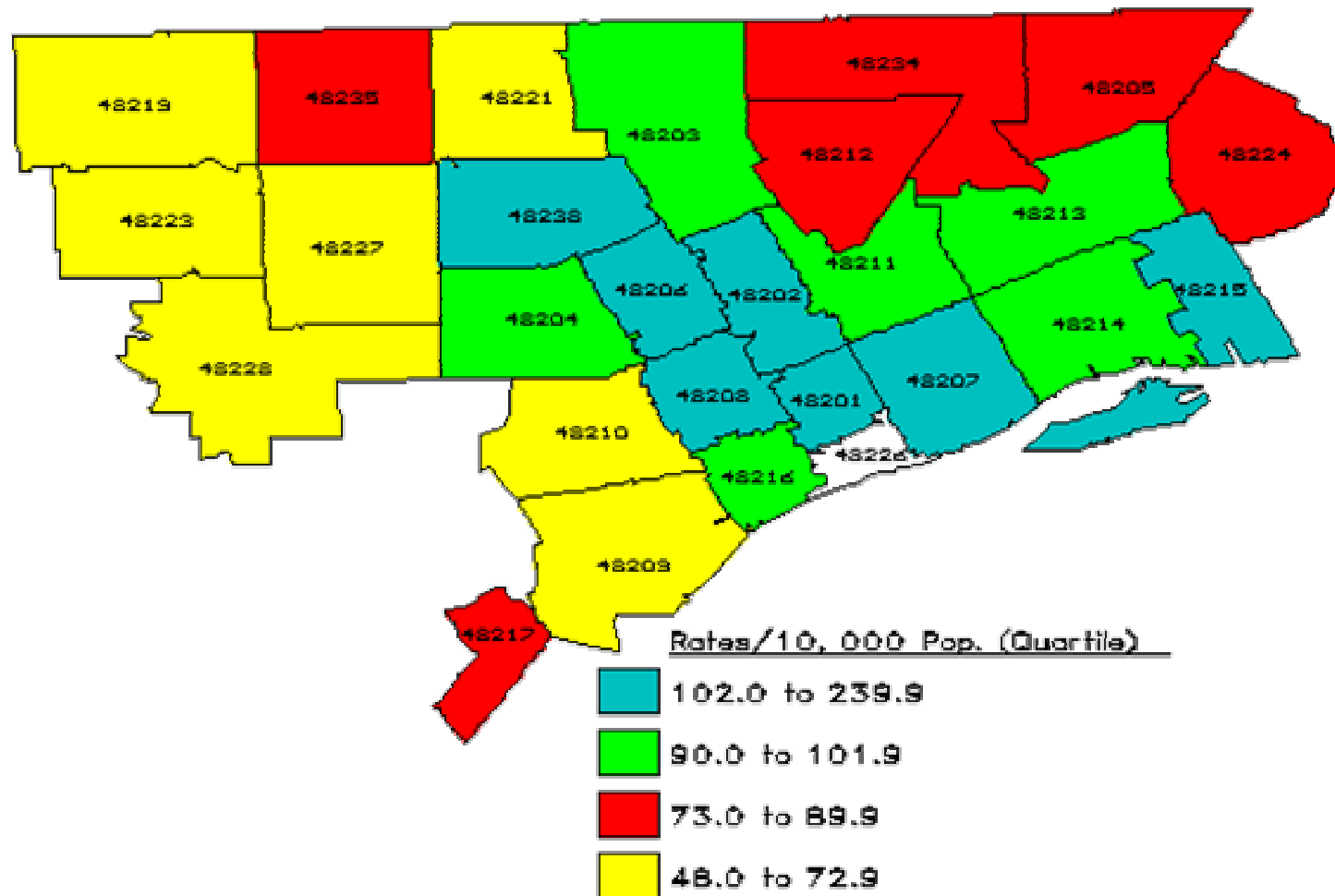
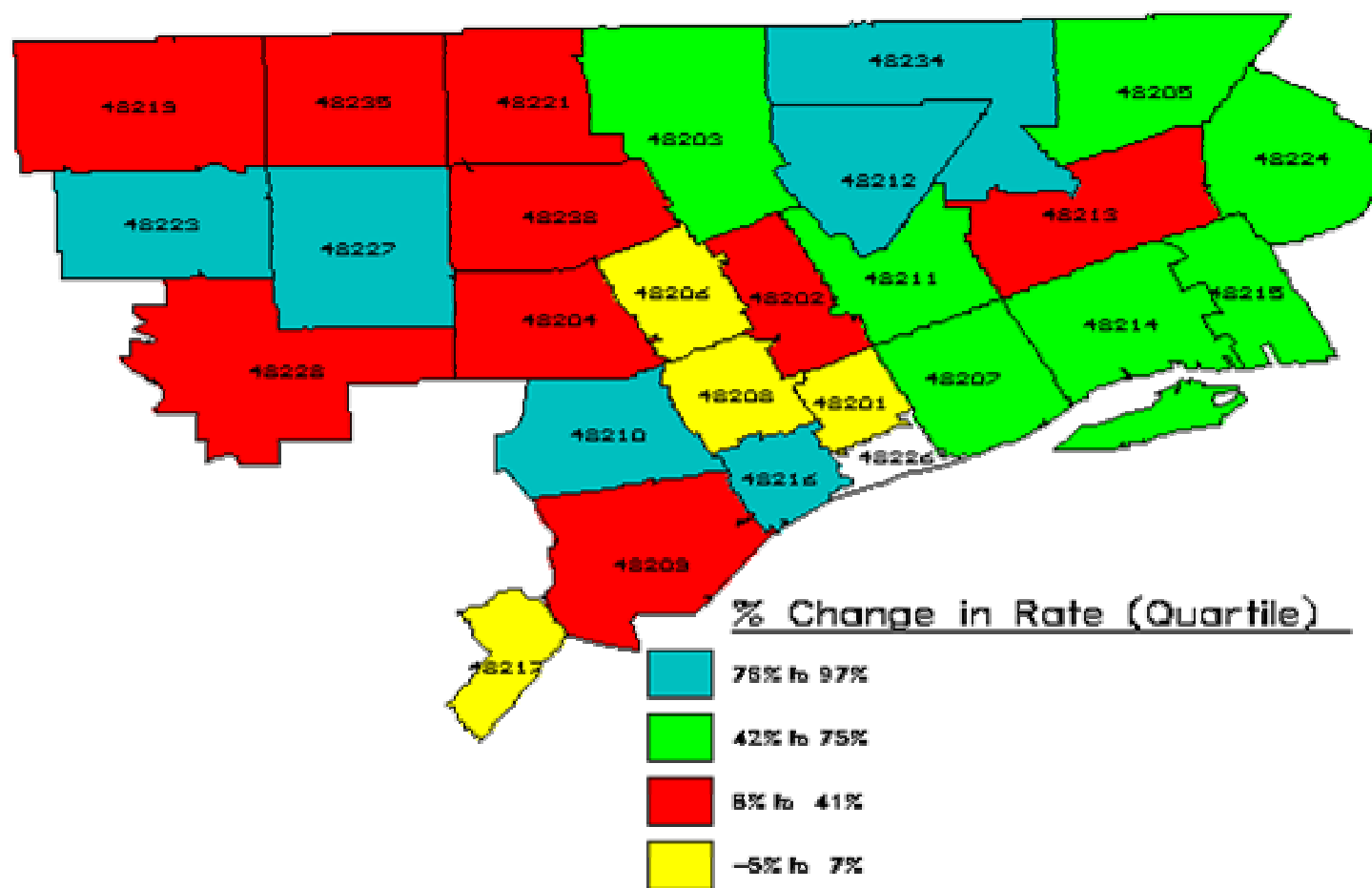


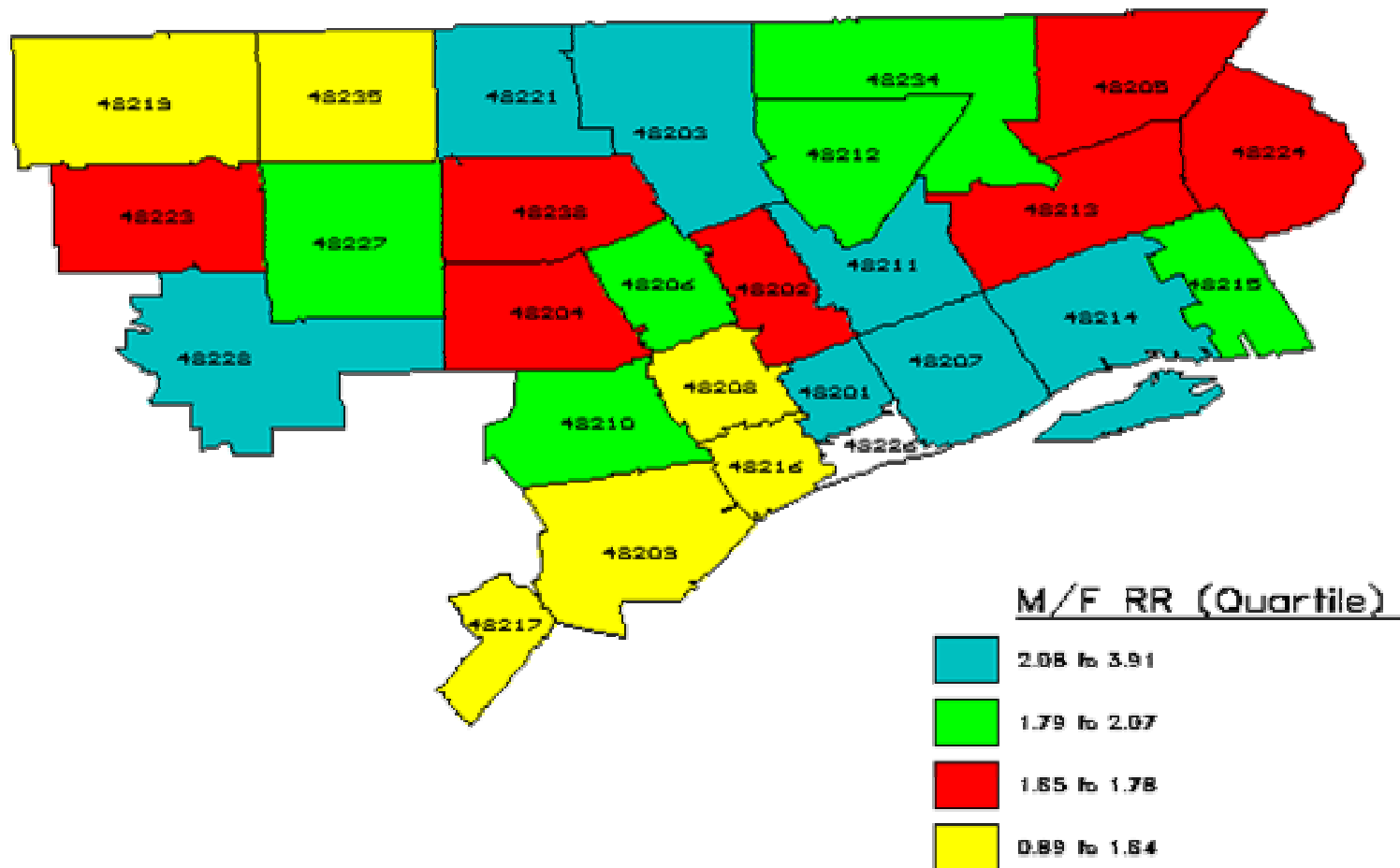
Figure 4: Relative Change in Childhood Asthma Hospitalization Rates from 1990 to 1996



Results - 2

- **Gender:** Male childhood asthma hospitalization rates were greater than female rates in nearly all zip codes (Fig. 5). Rate ratios varied from 0.89 to 3.91.
- **Age:** Preschool (1-4 years) rates were greater than school-aged (5-14 years) rates in all zip codes for both genders (Figs. 6 & 7).
- **Race:** Insufficient white population prohibited analysis.
- **Income:** Zip codes with higher childhood asthma hospitalization rates tended to have a higher percentage of households with income less than \$15,000 in 1990 (R-squared = 0.3921, Fig. 8).

Figure 5: Male to Female Childhood Asthma Hospitalization Rate Ratios, 1990-96



M Pre/School RR (Quartile)

Quartile	Range	Count
1	2.96 to 4.18	10
2	2.70 to 2.95	12
3	2.48 to 2.69	10
4	1.57 to 2.47	10

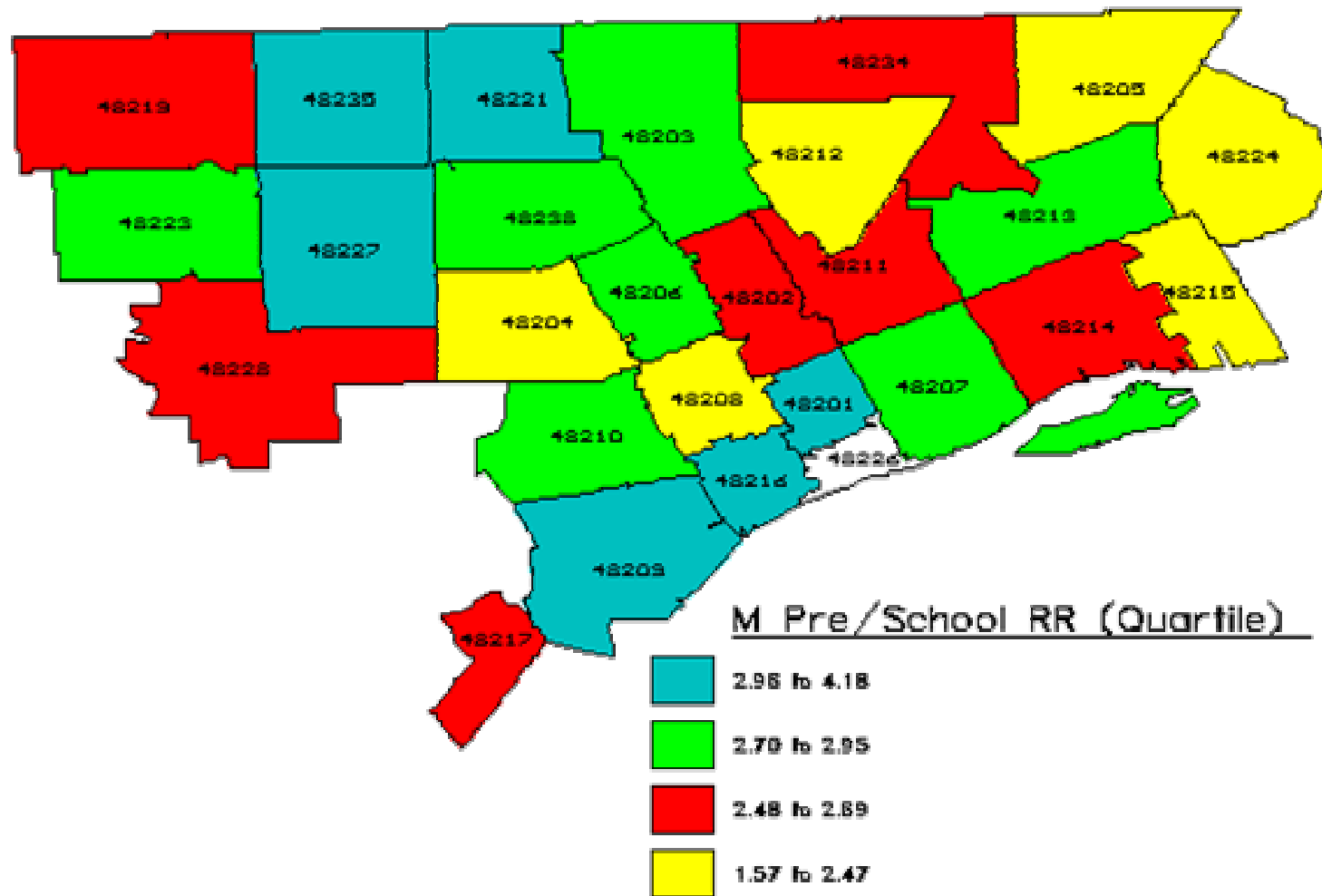
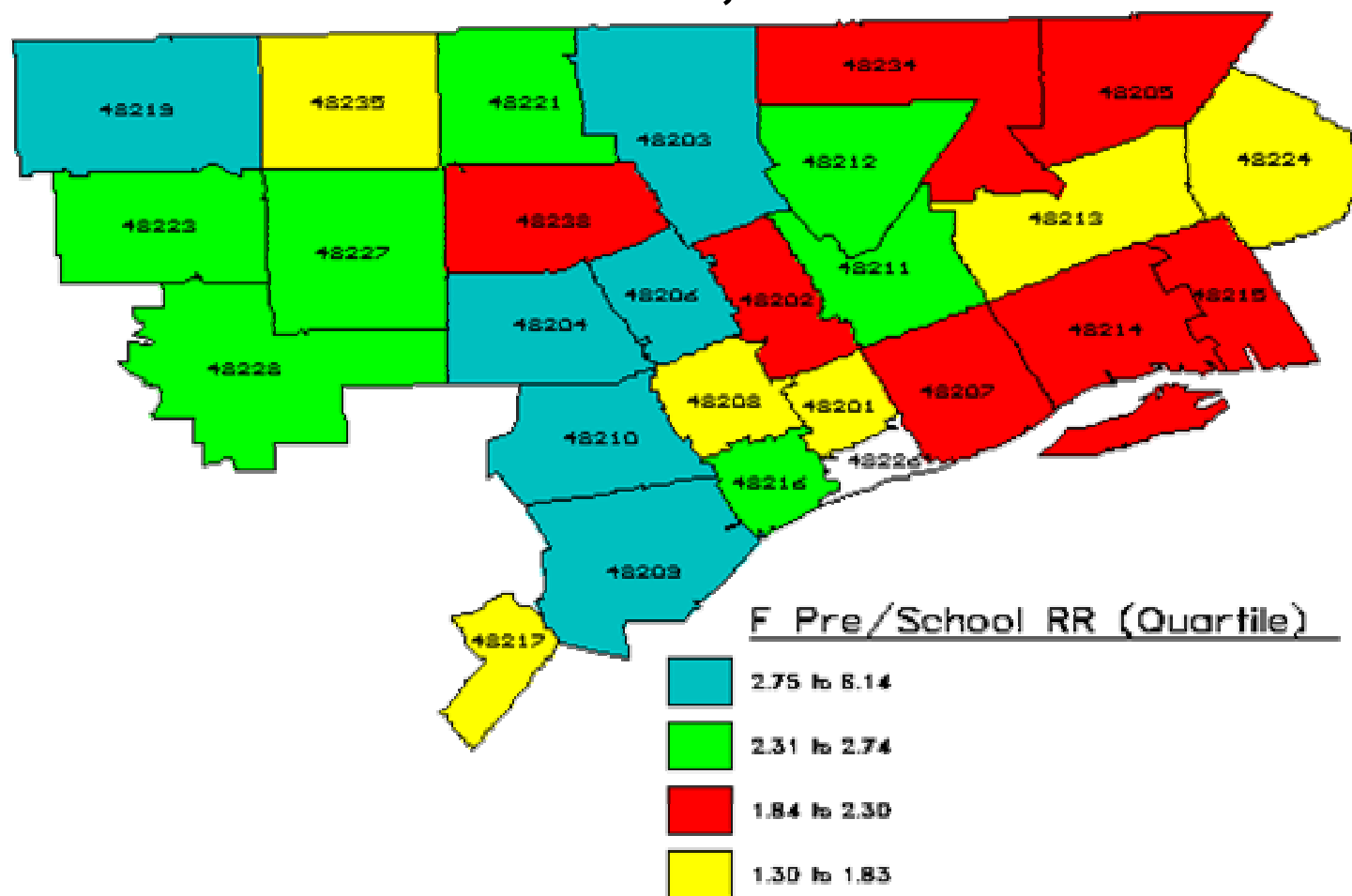
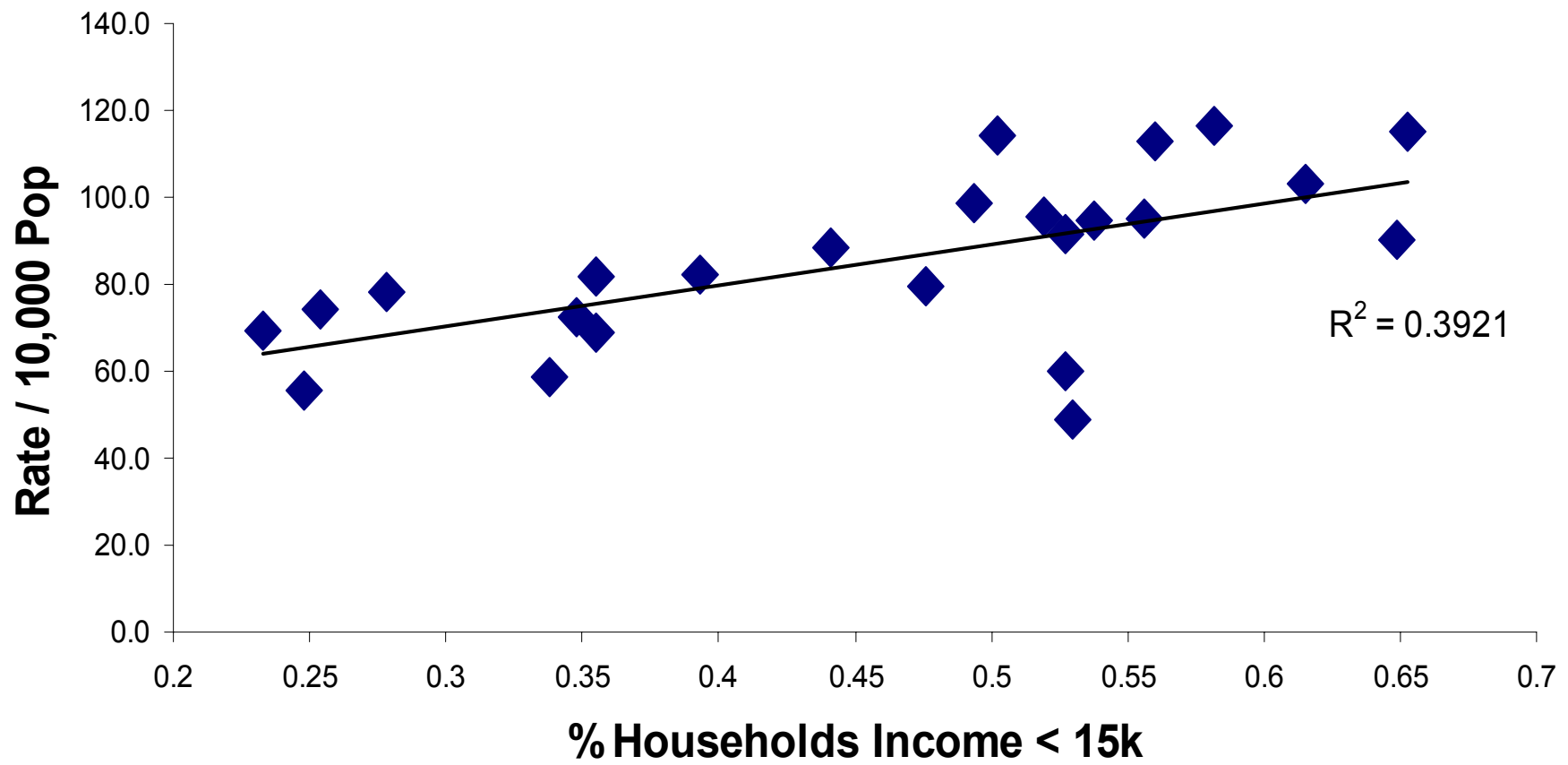


Figure 7: Preschool (1-4) to School-Aged (5-14) Asthma Hospitalization Rate Ratios - Females, 1990-96

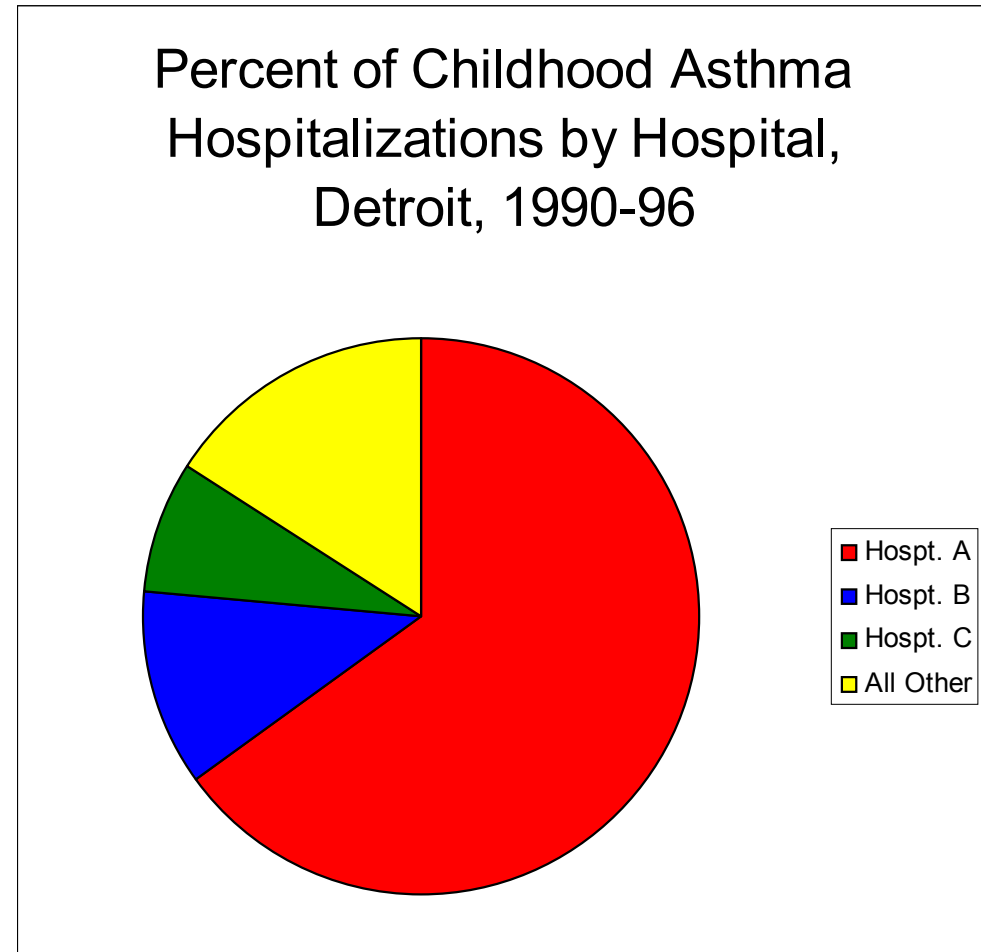


Childhood Asthma Hospitalization Rates 1990-96 & Percent Zip Code Households with 1990 Income < 15k



Hospital Usage

- 84% of all childhood asthma hospitalizations occurred in 3 Detroit hospitals
- 65% occurred in 1 Detroit hospital, which drew cases from all zip codes.



Other Health Care Related Factors

- Comorbidity:
 - Zip codes with the highest rates of childhood asthma hospitalizations also had the largest number of comorbidity diagnoses per asthma hospitalization
- Payment Method:
 - The most frequent payment method was Medicaid (Zip code median = 39%, Range: 29-56%).
- Length of Stay Less than Three Days:
 - The majority of all hospitalizations lasted less than 3 days (Zip code median = 70%, Range: 60-77%)

Limitations

- MIDB file may contain more than one admission per patient
- 1990 zip code population was used for all denominators
- Cell size became too small at zip code level for some analyses
- Limitations of ecological analysis

Conclusions & Potential Implications for Public Health - 1

- Zip code level analyses of Detroit showed variation in the rate of childhood asthma hospitalizations.
- Zip code level analysis is useful in identifying areas to target residential, day-care, school, or hospital-based education programs, interventions, or etiologic studies.

Conclusions & Potential Implications for Public Health - 2

- Examples of possible targeting for education programs, interventions, or etiologic studies.
 - The 5 Detroit zip codes above the median for both rates and number of childhood asthma hospitalizations may provide a good setting for residential- or school-based intervention pilot studies.
 - Targeting hospital-based interventions at one Detroit hospital could potentially effect 65% of all childhood asthma hospitalizations in Detroit.